Future Urbanization & Mega-Regions

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Market driven
Transformative change

Growth
Urbanization
Rise of the mega-regions
Congestion
Transformation
Growth = International
Majority air travel growth in China, India, and Brazil

Air more geographically diverse
• Emerging populations/regions:
  - 66% will travel in 2033
  - 2003 RPK share 39% → 52% 2013

Anticipated Passenger Air Trips By Country
2012, Air Trips per Capita vs. GDP per Capita

2013 | 2033
0.8M → 2.2M
daily pax

500 million trips
Agglomeration strongest urban market effect
May drive need for compatible energy as well as austere fields

Worldwide Urbanization
2012 portion population living in urban areas

Large populations that will urbanize over the next 2-3 decades

Brazil and most of Latin America is already highly urbanized
Urbanization growth will exacerbate hub transport pains
Per Capita GDP & Urbanization rate risen in tandem

1950 New York City
1st metropolitan area to hit 10M
  - Today 19 urban agglomerations (41 by 2030)

1962 Tokyo
1st city @ 10M Mega-city
  - 2030 largest city 37M Tokyo-Yokohama area (~2% world GDP)
  - Delhi 36M
Global city urbanization following North American blueprint … but faster & larger scales

**Rapid population/urban growth**

- New city (1M) every 5 days until 2050
- Adds 65M people/year (2.5B)
  → 90% concentrated Asia/Africa
  → 36% growth due to India (404M), China (292M) and Nigeria (212M)
- 5B world **urban** population → 2030
  6.4B to 8.4B → 2100

**Today 59 countries > 80% urban**

- Belgium 98%, Japan 93%, Netherlands 90%, USA 82%, Latin America/Caribbean 80%, EU 73%
- Africa/Asia 40/48 today 56/64 by 2050

**89 countries by 2050**

- 196 countries today total

**More evident in developing countries**

- China highest

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**Metropolis Growth**

\[
y = 1.9218 \times 10^{-23} e^{0.029039X}
\]

- 3X Mega-cities since 1990

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GDP & urban megacity agglomeration rise

55% large cities will be in Asia

Global urban population growth propelled by city growth

<table>
<thead>
<tr>
<th>Region</th>
<th>2010</th>
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<th>Total</th>
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<tr>
<td>Europe</td>
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</tbody>
</table>
Mega-cities anchor Mega-regions
Multiple city clusters/airports, often 100+ miles across

Mega-City and Mega-Region
Los Angeles 2013

Rio & San Paulo
> 50M

Central India
> 90M

Shanghai
> 100M

Mega-City & Mega-Region
Shanghai 2013

Mega-City
19M

Regional

Regional

Regional

Mega-Region
26M

Mega-City
19M

Regional

Regional
Urbanization → Mega-City agglomerations

Mega-Region variations represented by Archetypes

**Single-City**
Developing:
Shanghai, Chongqing, Chengdu, Wuhan, Manila, Jakarta, Karachi, Lagos, Kinshasa, Cairo.

**Dual-City**
Tokyo & Osaka
Sao Paulo & Rio de Janeiro
Johannesburg/Pretoria “Jotoria”
Developing:
Beijing & Tianjin,
Delhi & Lahore,
Kolkata & Dhaka

**Multi-City**
Mumbai, Chennai, Bangalore, Hyderabad

**Mega-Corridor**
Guangzhou, Shenzhen, Hong Kong
will house 120M people by 2025
Growth chokes central hub-n-spoke
Air/Office parks serve expanding metropolitan business regions

Finite infrastructure can’t accommodate growth
- Airports congested/saturated
  - Long & invasive security queues
- More traffic, more noise, more pollution

Door-to-Door

Gridlocked ATM
- Limited gates/ramps
- Fewer takeoff/landing slots
- Landlocked runways
It’s difficult to make predictions, especially about the future. Danish Proverb

Dispersed & Dynamic freedom can vividly alter current Centralized & Static airfield paradigm

23% flights and 2.5% seat-miles are < 300 nm

... today

... what is urban access effect?

World Airfields

What happens when office parks or shopping centers become ‘airfields’?
Urban community acceptance
Hub-n-Spoke → Door-to-Door (noise/Safety critical)

**Airpark urban access**
- V/SSTOL
- Near Silent (< 60 dBa)
- Zero emission (goal)
  - Lower (objective), Compliant (threshold)
  - 90% Nox, 75% CO2 /pax-km

**Safety**
- Robust, forgiving
- Perceived .vs. Actual
- Reliable ≠ Safe

**Comfort & Convenient**
- Non-evasive security
- Improve overall transit

**Affordable**
- Flexible/available 24x7
  - Relieve congestion
  - Low barrier infrastructure
  - Avoid curfews, fines or bans
- Low costs (build, acquire, operate)
- Durable, RM&S
  - Available/Compatible energy
What if energy was 1/10th cost and renewable?

*The definition of insanity, is doing the same thing over and over, and expecting different results.*“ - Rita Mae Brown

**Leapfrog development stages**

→ Avoid paths others passed through
   (e.g. China cells vs US lines)
Accelerating change acceptance
Quicker absorption by developing states

Rapid disruption adaptation
• UBER, LYFT, SIDECAR

What’s next?
Evolution or Revolution?
Given lemons, make lemonade

Central hub-n-spoke → → →
Big aircraft + long range + high speed = more energy

Dispersed point-2-point
Small aircraft + short range + low speed = less energy = No/low Noise/emissions

What rules today can be disrupted?
What familiar patterns can be challenged?

“‘You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.”
— Richard Buckminster Fuller
Emergent market challenges motivate Safety + Silence + Emissions + V/STOL + Affordable
Why not explore new urban mobility market?
Workshop should seek/develop advocacy

Access what was once inaccessible
→ Connect/reach nodes with little or no service

Productivity
→ Minimize non-value time
→ Multi-destination quick & efficient

Responsibly to environment

Improve safety/security

Dynamic & flexible
→ Schedule
→ Mission: Cargo, medical, humanitarian, etc.

Charge entrepreneurial spirit
→ Kick start new industries
No free lunches

Questions?